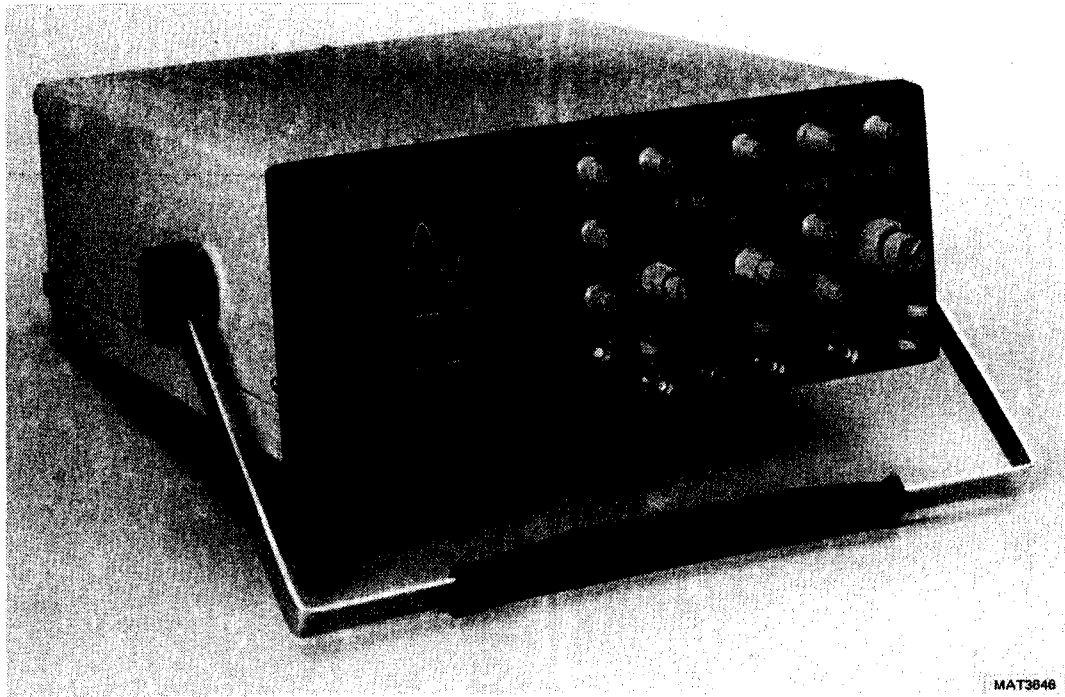


40 MHz Dual Channel Oscilloscope PM3209

Operation Guide

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PHILIPS

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OPERATING MANUAL

GEBRAUCHSANLEITUNG

NOTICE D'EMPLOI

GEbruIKSAANWIJZING

BRUGSANVISNING

ISTRUZIONI D'USE

INSTRUCCIONES DE MANEJO

IMPORTANT In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

NOTE *The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.*

WICHTIG Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und die Gerätenummer anzugeben. Diese befinden sich auf dem Leistungsschild.

BEMERKUNG *Die Konstruktion und Schaltung dieses Gerät wird standig weiterentwickelt und verbessert. Deswegen kann dieses Gerät von den in dieser Anleitung stehenden Angaben abweichen.*

IMPORTANT Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez toujours indiquer le numéro de type et le numéro de série sont marqués sur la plaquette de caractéristiques.

REMARQUES *Cet appareil est l'objet de développements et améliorations continus. En conséquence, certains détails mineurs peuvent différer des informations données dans la présente notice d'emploi et d'entretien.*

BELANGRIJK Bij correspondentie betreffende dit instrument graag type-en serie nummer, zoals op het type plaatje staan, opgeven.

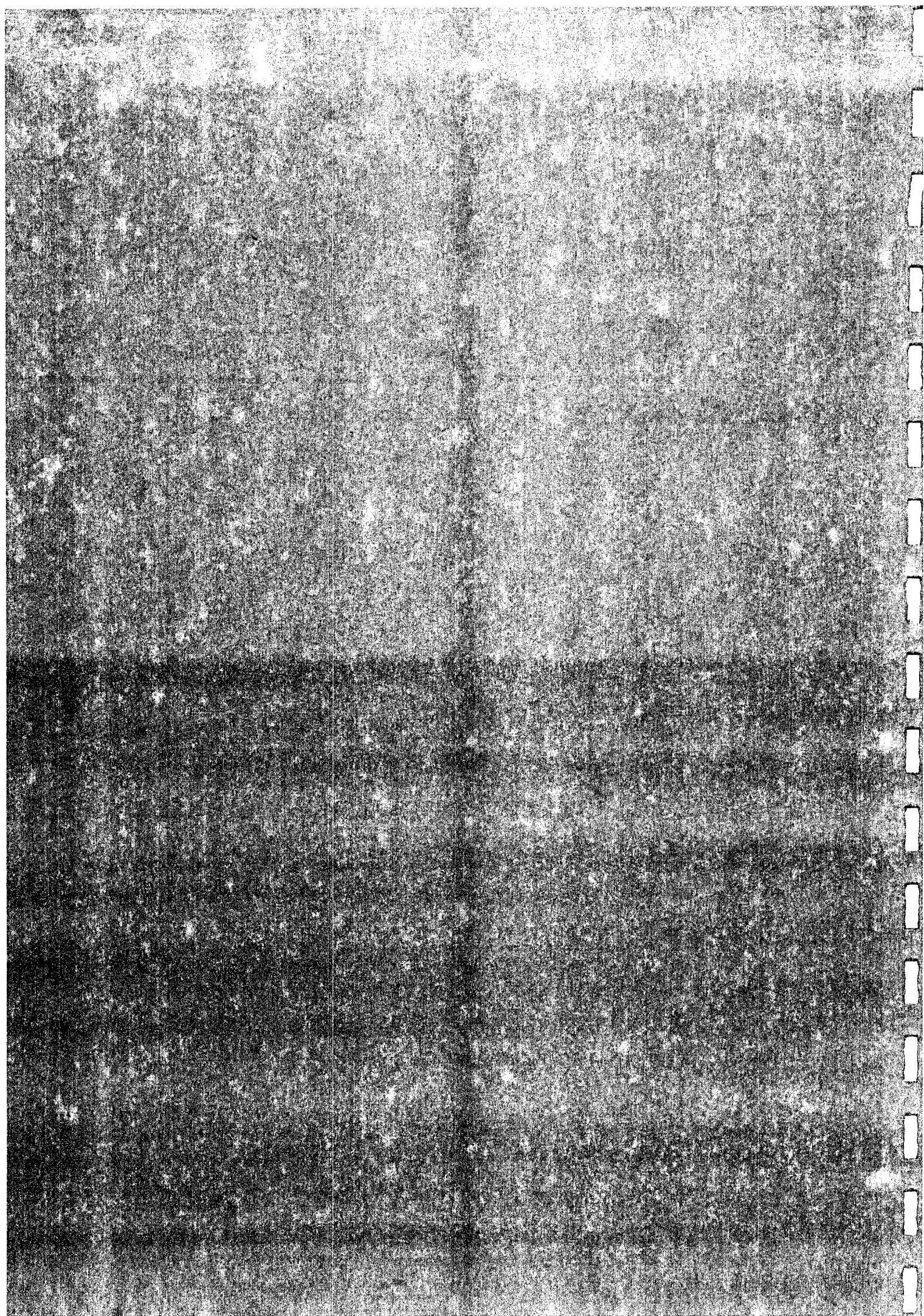
OPMERKING *De constructie en de schakelingen in dit apparaat worden continu verder ontwikkeld en verbeterd. Daarom kan dit apparaat in geringe mate afwijken van de in deze gebruiksaanwijzing opgenomen informatie.*

- VIGTIGT** Ved korrespondance angaaende dette instrument, angiv venligst typenummer og serienummer som angivet på typepladen.
- BEMAERK** *Konstruktionen af dette instrument er under konstant videreudvikling, hvorfor der kan forekomme mindre afvigelser fra angivelserne i denne manual.*
- IMPORTANTE** Nella corrispondenza riguardante questo strumento Vi preghiamo voler citare il numero do tipo completo ed il numero di matricola come riportati dalla targhetta posta sul retro dello strumento.
- NOTA** *Questo strumento è soggetto a continui aggiornamenti e miglioramenti, quindi per alcuni dettagli può essere differente dalle informazione contenute nel presente manuele.*
- IMPORTANTE** Para cualquier consulta o reclamacion sobre este aparato, Indicar siempre el numero de fabricación que figura en la placa.
- NOTA** *El diseño de este instrumento es objeto de continuous desarrollos y mejaros. En consecuencia, el equipo puede incluir diversas modificaciones con respecto ala información facilitada en este modo de empleo.*

OPERATING MANUAL

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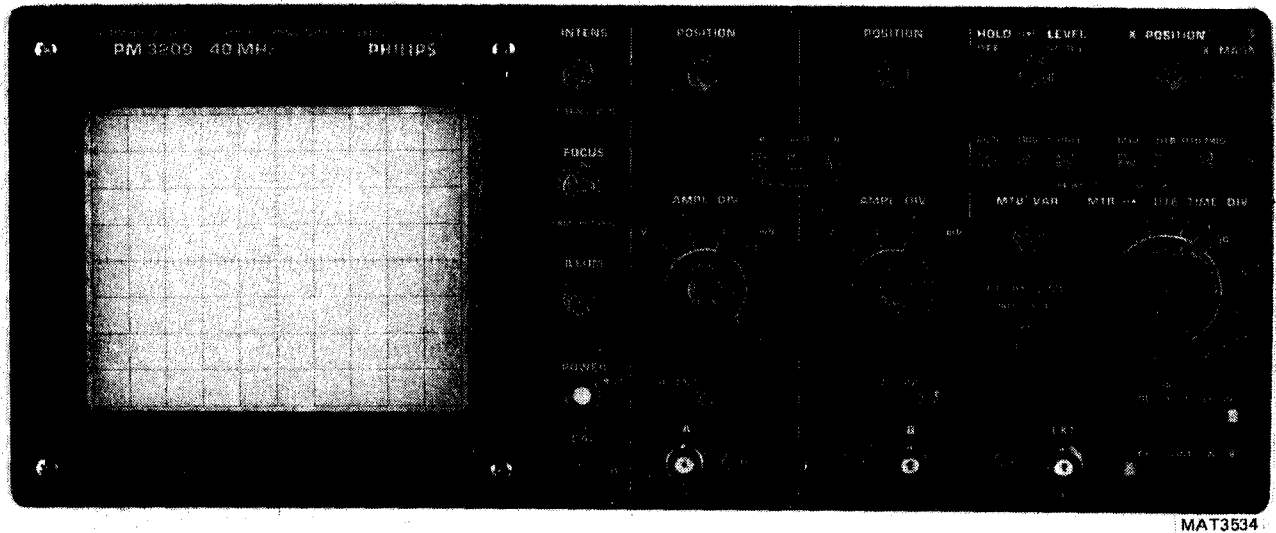
SHIPMENT NOTE

The following parts should be included in the shipment:

- 1 OSCILLOSCOPE
- 1 OPERATION GUIDE
- 1 SERVICE MANUAL
- 2 FUSES
- 2 PROBES
- 1 MAINS VOLTAGE CORD

INITIAL INSPECTION

Check the contents of the shipment for completeness and note whether any damage has occurred during transport. If the contents are incomplete, or there is damage, a claim should be filed with the carrier immediately, and the Philips/Fluke Sales or Service organisation should be notified in order to facilitate the repair or replacement of the instrument.



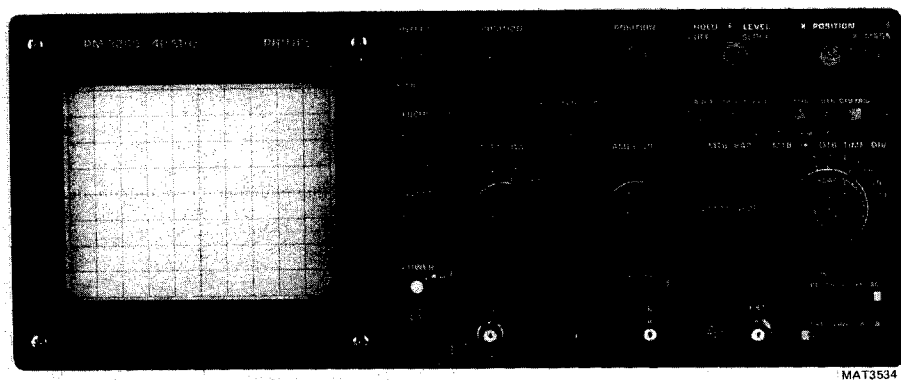
Thank you for purchasing this Philips oscilloscope. It has been designed and manufactured to the highest quality standards to give you many years of trouble free and accurate measurements.

The powerful measuring functions listed below have been combined with an easy logical operation to let you use the full power of this instrument each and every day.

Should you have any comments on how this product could be improved then please contact your local Fluke/Philips organisation.

PM 3209 Main Capabilities

- Large 8 x 10 cm screen
- Full 40 MHz bandwidth with 5 mV sensitivity
- Main time-base **and** delayed time-base
- Automatic triggering for stable trace
- TV triggering for TV and video applications
- Choice of triggering from A or B channels or externally
- External Z-modulation facility



MAT3534

Thank you for purchasing this Philips oscilloscope. It has been designed and manufactured to the highest quality standards to give you many years of trouble free and accurate measurements.

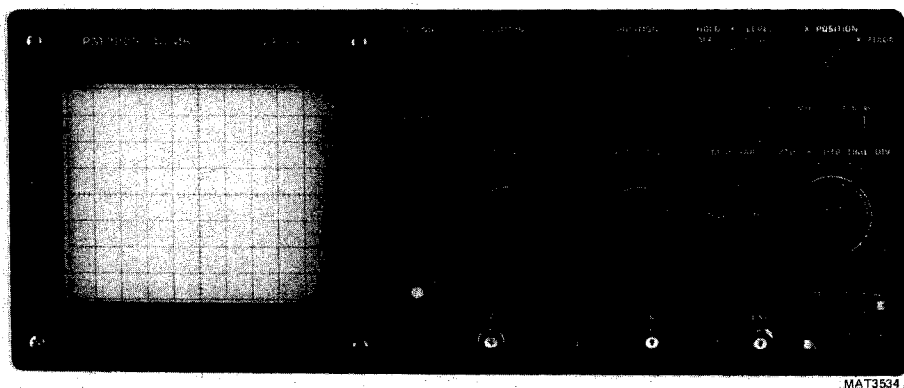
The powerful measuring functions listed below have been combined with an easy logical operation to let you use the full power of this instrument each and every day.

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PM 3209 Main Capabilities

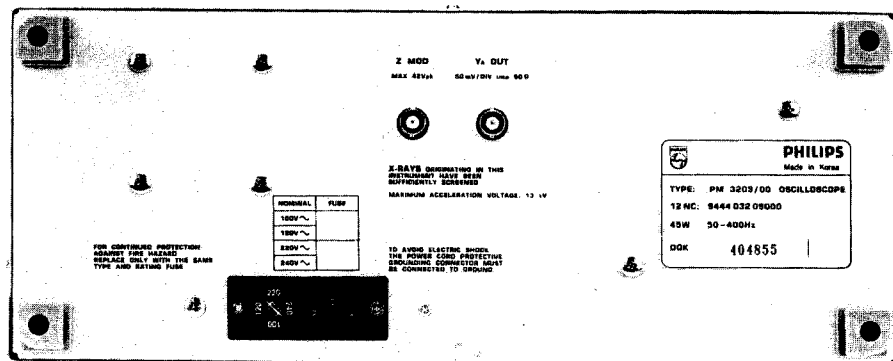
- Large 8 x 10 cm screen
- Full 40 MHz bandwidth with 5 mV sensitivity
- Main time-base **and** delayed time-base
- Automatic triggering for stable trace
- TV triggering for TV and video applications
- Choice of triggering from A or B channels or externally
- External Z-modulation facility

FRONT VIEW OF OSCILLOSCOPE



MAT3534

REAR VIEW OF OSCILLOSCOPE



MAT3973

FRONT PANEL CONNECTORS

- CAL** Amplitude calibrated output socket.
- ⊥** Measuring earth socket.
- A** BNC input socket for channel A.
- B** BNC input socket for channel B.
- EXT** BNC input socket channel EXTERNAL

REAR PANEL CONNECTORS

- Z-MOD** BNC input socket for Z-modulation of the CRT trace.
- YA OUT** BNC output socket of the vertical (YA) signal.
- LINE IN** Mains input socket including fuseholder.

1 OPERATORS SAFETY

ATTENTION: *Read this page carefully before installation and use of the instrument.*

1.1 INTRODUCTION

The instrument described in this manual is designed to be used by properly-trained personnel only. Adjustment, maintenance and repair of the exposed equipment shall be carried out only by qualified personnel.

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally-accepted safety procedures in addition to the safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.3 CAUTION AND WARNING STATEMENTS

- CAUTION:** Is used to indicate correct operating or maintenance procedures in order to prevent damage to or destruction of the equipment or other property.
- WARNING:** Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.

1.4 SYMBOLS



Read the operating instructions.



Protective earth (black)
(grounding) terminal

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety-protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

2 INSTALLATION INSTRUCTIONS

ATTENTION: *You are strongly advised to read this chapter thoroughly before installing your oscilloscope.*

2.1 SAFETY INSTRUCTIONS

2.1.1 EARTHING

Before any connection to the input connectors is made, the instrument shall be connected to a protective earth conductor via the three-core mains cable; the mains plug shall be inserted only into a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension cord without protective conductor.

WARNING: **Any interruption of the protective conductor inside or outside the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.**

When an instrument is brought from a cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing requirements are strictly adhered to.

2.1.2 LOCAL MAINS SETTING AND FUSES

Different power cords are available for the various local mains voltage outlets. The power cord version delivered is determined by the particular instrument version ordered.

Before connecting the instrument to the mains (line), make sure that it is set to the local mains (line) voltage.

If the instrument is to be used with an other supply voltage, the appropriate voltage should be selected by adapting the mains selector on the rear panel. This is incorporated with the mains (line) input socket. An arrow on the fuse holder indicates the proper supply voltage. Take notice that changing between 100/120 V and 220/240 V needs also adaptation of the mains fuse.

NOTE: *If the mains (line) plug has to be adapted to the local situation or if the mains (line) voltage has to be set to the local mains (line) voltage, such adaptation should be done only by a qualified technician.*

WARNING: **The instrument shall be disconnected from all voltage sources when renewing a fuse.**

Mains fuse rating:



630 mA/ 250 V delayed action for 100 V and 120 V line voltage.

315 mA/ 250 V delayed action for 220 V and 240 V line voltage.

The mains fuseholder is located on the rear panel. If the mains fuse needs replacing, proceed as follows:

- Disconnect the instrument from the mains (line).
- Remove the cover of the fuse holder by means of a screwdriver.
- Fit a new fuse of the correct rating and refit the cover of the fuse holder. Take notice that the proper voltage must coincide with the arrow on the fuse holder.

WARNING: **Make sure that only fuses of the required current and voltage rating, and of the specified type, are used for renewal. The use of the repaired fuses, and/or short-circuiting of the fuseholder, is prohibited.**

2.2 HANDLE ADJUSTMENT AND OPERATING POSITIONS

By pressing both handle ends towards to the instrument, the handle can be rotated to the following operating positions:

- vertically on its rear feet,
- horizontally on its bottom feet,
- in three sloping positions of the handle.

ATTENTION: *Do not position the oscilloscope on any surface which radiates heat, or in direct sunlight. Ensure that the ventilation holes at the bottom, top and sides are free from obstruction.*

3 OPERATING INSTRUCTIONS

3.1 GETTING STARTED

- Connect your oscilloscope to the mains voltage.
- Switch the oscilloscope on by means of the pushbutton POWER ON.
- Set all rotary knobs in their calibrated- or mid-position.
- Set channel A and channel B to GND for a grounded display.
- Select AUTO trigger mode.
- Adjust the TRACE ROTATION by means of a screwdriver so that the trace is parallel with the horizontal graticule lines.
- Connect a probe to input A of the oscilloscope.
- Connect the other end of the probe to the CAL output of the oscilloscope.
- Set AC-GND-DC switch to DC.

If the probe you use is an attenuator probe 10:1 or 100:1 you may have to adjust your probe for the correct compensation, according to the probe instructions.

3.2 OPERATION

3.2.1 SCREEN CONTROLS

After switching on, the screen controls can be adjusted for an optimum illumination, trace and spot quality.

The trace intensity is set by the INTENS rotary knob, and a sharp display is obtained by the FOCUS rotary knob.

The intens ratio between the MTB trace and the intensified part of the MTB (MTBI) can be adjusted by the screw driver control INTENS DTB.

The screw driver control TRACE ROTATION is used to set a grounded trace parallel with the horizontal graticule lines.

The graticule of the screen can be lit-up by the ILLUMINATION rotary knob, this can be used in dark environment or for making photographs.

3.2.2 VERTICAL MODE

- AMPL/DIV** Outer knob:
Selection of deflection coefficients.
Range: 5 mV/div ... 5 V/div in a 1-2-5 sequence.
Inner knob:
Variable control of channel amplitude, is in calibrated position when fully clockwise.
When pulled the gain is magnified five times.
- POSITION** Variable vertical position control.
When pulled, channel B is displayed inverted.
- AC-GND-DC** Channel input coupling switches.
AC: Input signal coupled via blocking capacitor and DC component is blocked.
GND: Input amplifier is grounded.
DC: Input signal is directly coupled.
- A-ADD-B** Selection of the various vertical modes.
A: Only channel A is displayed on the screen.
B: Only channel B is displayed on the screen.
DUAL: Channels A and B are both displayed on the screen.
Alternated display for 0,2 μ s/div ... 0,5 ms/div.
Chopped display for 1 ms/div ... 0,5 s/div.
ADD: Displays sum (A + B) or difference (A-B) of both channels.

3.2.3 HORIZONTAL MODE

- MTB TIME/DIV** Outer knob:
Selection of main time-base deflection coefficients.
Range: 0,2 μ s/div ... 0,5 s/div in a 1-2-5 sequence.
When fully counter-clockwise it selects X DEFL mode.
- DTB TIME/DIV** Inner knob:
Selection of delayed time-base deflection coefficients.
Range: 0,2 μ s/div ... 0,5 ms/div in a 1-2-5 sequence.
- MTB VAR** Variable control of the time-base sweep speed, is in calibrated position when fully clockwise.
- X POSITION** Horizontal position control.
X MAGN When pulled, sweep speed is magnified 10 times.

- DELAY TIME** Continuously variable control of the delay time.
Outer knob: Coarse adjusting of the delay time.
Inner knob: Fine adjusting of the delay time.
- MTB** Selection of the various horizontal modes.
DTB MTB: Selection of main time-base.
DTB TRIG DTB: Selection of delayed time-base.
MTBI: Selection of main time-base intensified.
DTB TRIG: Delayed time-base is triggered.
- AUTO** Selection of the various trigger modes.
TRIG AUTO: Sweep runs free in absence of trigger signals.
SINGLE TRIG : Sweep runs after receipt of trigger signal.
SINGLE: Sweep runs only once after receipt of trigger signal.
When pushed, the time-base is reset so it can start again on a new trigger pulse.
- TRIG or X DEFL** Selection of the various trigger coupling modes.
DC: All frequency components of applied signal are coupled to the trigger circuitry.
AC: Trigger signal coupled via blocking capacitor and DC component is blocked.
TV: Triggers on TV synchronization pulses.
Ranges 0,2 μ s/div ... 50 μ s/div selects TV-L (LINE).
Ranges 0,1 ms/div ... 0,5 s/div selects TV-F (FRAME).
AC-LF: Signal components upto 50 kHz are coupled to trigger circuitry.
- X DEFL** Selection of the various trigger sources.
EXT: Time-base can trigger on signal derived from EXT input.
LINE: Time-base can trigger on signal derived from the mains voltage.
A : Time-base can trigger on signal derived from channel A.
B : Time-base can trigger on signal derived from channel B.

HOLD OFF	Outer knob: Variable control of the hold-off time.
LEVEL	Inner knob: Determines the trigger point at which the main time-base starts. When fully counter-clockwise it is in a fixed position. When pushed the main time-base starts on the rising edge of the trigger signal. When pulled the main time-base starts on the falling edge of the trigger signal.

3.2.4 INPUTS AND OUTPUTS

A	BNC input socket for channel A or in X DEFL: input terminal for X-axis.
B	BNC input socket for channel B or in X DEFL: input terminal for Y-axis.
CAL	Output socket providing a 1 V(p-p) square-wave voltage for calibration of probe adjustment.
EXT	BNC input socket; When EXT input is selected via the time-base, the signal input is used for external triggering. When EXT input socket is selected via X DEFL, the horizontal deflection is determined by the signal applied to this socket.
Z-MOD	BNC input socket for Z-modulation of the CRT trace. The trace is blanked when this input is "high" ($> +2,5 \text{ V}$).
YA OUT	BNC output socket providing an output signal that is a normalized representation of the channel A input signal.
LINE IN	Mains (line) input socket including fuse holder. The fuse holder has four different positions to select the mains (line) input voltage. An arrow indicates the selected voltage.

4 APPLICATIONS

To use the instrument, three main functions need first to be defined.

These are:

- Vertical mode
- Horizontal mode
- Trigger mode

First ensure the oscilloscope is set to the preliminary settings as described in Section 3.1. Further adjustments and selections can then be made by operating the various switches and potentiometers.

The most important applications are described in this chapter.

4.1 VERTICAL MODE

- **Vertical display mode selection**
by the A-ADD-B switch

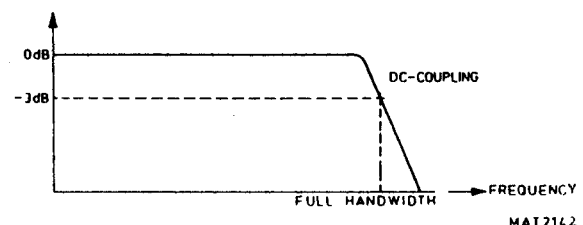
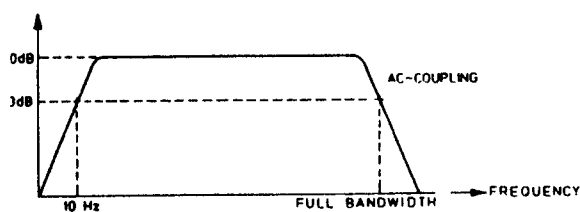
Select the channel you want to see A, B, A and B simultaneously or A and B added or subtracted. Selection of various combinations is also possible.

- **Channel coupling**
by the AC-GND-DC switch

In AC position the DC component of the measuring signal is rejected.

In DC position the full bandwidth is available.

AC coupling is used when a small AC signal has to be measured that is superimposed on a large DC voltage. For example, ripple measurements on power supply voltages.



MAT2142

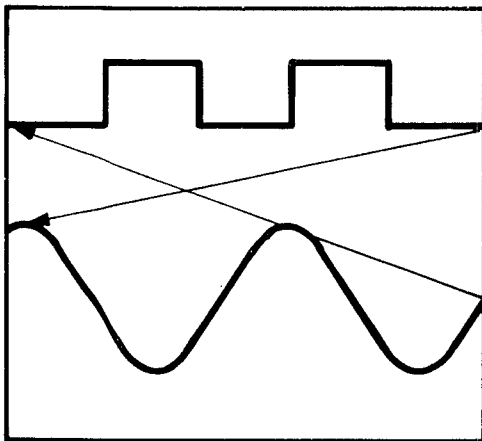
- Alternated or chopped display

When channels A and B are both displayed on the screen (DUAL selected), these signals are displayed alternately for $0,2 \mu\text{s}/\text{div} \dots 0,5 \text{ ms}/\text{div}$ or chopped for $1 \text{ ms}/\text{div} \dots 0,5 \text{ s}/\text{div}$.

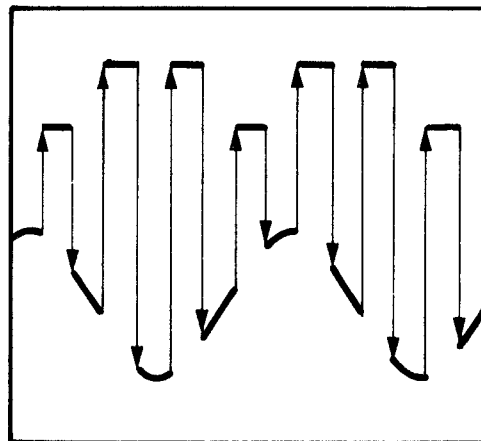
In alternated mode, the CRT beam alternately traces one signal sweep and then the other.

In chopped mode, the beam chops from one channel to the other at fast switching frequency.

ALTERNATED DISPLAY



CHOPPED DISPLAY



- ADD, normal or inverted display

Note: INVERT is only active on channel B.

When ADD has been depressed, channel B is added to channel A ($A + B$), but when channel B is also inverted by pulling the channel B POSITION rotary knob, this channel is subtracted from channel A ($A - B$). The differential mode ($A - B$) is useful for rejecting common-mode signals. By measuring in differential mode, the common-mode signal on one channel cancels out the common-mode signal on the other channel leaving the actual signal visible on the display.

A practical application on the differential mode is to eliminate hum from a signal.

4.2 HORIZONTAL MODE

- **Horizontal display mode selection**
by MTB-DTB-DTB TRIG and MTB TIME/DIV switches

X DEFL selected:

When the MTB TIME/DIV rotary switch is fully counter-clockwise it selects the X DEFlection mode. The oscilloscope shows then one signal to be displayed as a function of another signal (X-Y graph). The required X-axis signal is selected by the trigger source switch (A-B-EXT-LINE).

The X DEFL mode has a wide range of applications, e.g.:

- amplitude vs frequency of circuits and filters.
- output current vs input voltage of semiconductors.
- comparison of frequency or phase shift using Lissajous figures.

MTB selected:

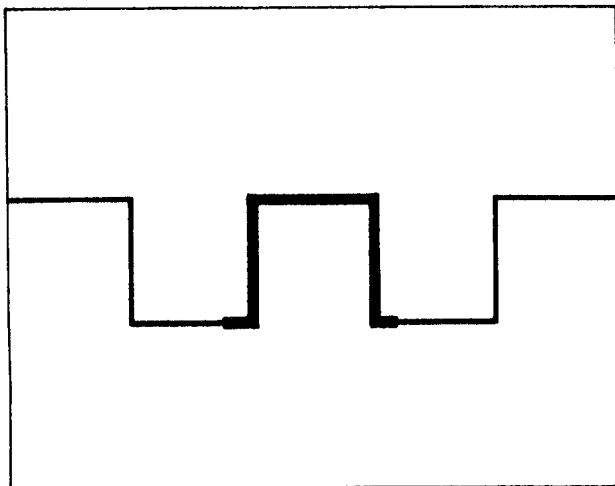
With the MTB TIME/DIV switch you can make a selection of the time-base speed in a 1-2-5 sequence and fine adjustments between these steps is obtained with the MTB VAR rotary knob.

Next the sweep speed can be magnified 10 times by pulling the X MAGN knob, which is incorporated in the X POSITION rotary knob. This knob shifts the trace across the screen in a horizontal direction.

MTBI selected:

The horizontal deflection is supplied by the MTB. One part of the trace, representing the DTB, is intensified. The length of the intensified part depends on the settings of the MTB and DTB TIME/DIV rotary switches. This intensified part can be shifted along the MTB trace by means of the DELAY TIME rotary knob (COARSE and FINE).

This mode can be used to locate a particular part of the signal to be displayed on the screen.



MAT 2143

DTB or DTB TRIG selected:

An expanded display is viewed which can be positioned anywhere along the 10 division of the main sweep. With the DTB TIME/DIV switch you can make a selection of the DTB speed in a 1-2-5 sequence. This speed can never be lower than the MTB TIME/DIV switch. This mode can be used for a more accurate study of complex signals.

4.3 TRIGGER MODE

- **Trigger mode selection**
by the AUTO-TRIG-SINGLE switch

The main time-base can operate in three modes:

- AUTO: The horizontal sweep normally starts when a trigger occurs. If no trigger is detected within 100 ms after the last sweep, then a sweep start automatically occurs. This means a trace is always visible on the screen.
- TRIG: The horizontal sweep will only start on a trigger pulse derived from the selected trigger source.
- SINGLE: The horizontal sweep runs only once after it is armed (RESET lamp is then burning) and the receipt of a trigger pulse derived from the selected trigger source. The mode is very useful to capture single events.

- **Trigger source selection**
by the A-B-EXT-LINE switch

The trigger sources can be selected from:

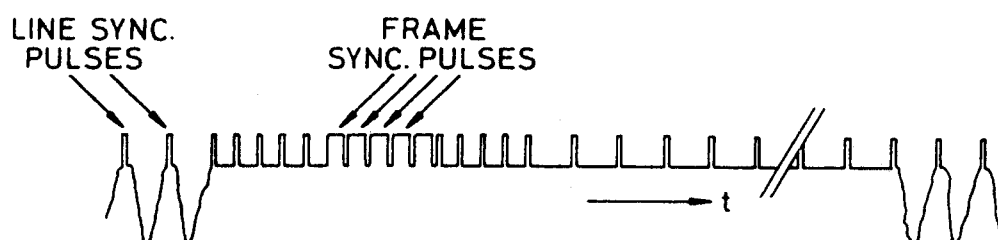
- A channel A
- B channel B
- EXT EXTERNAL channel
- LINE 50 Hz or 60 Hz sine-wave derived from the mains voltage

- **Trigger coupling selection**
by the DC-TV-AC LF-AC switch

As trigger coupling can be chosen between:

- DC The trigger signal is directly coupled to the trigger circuit and gives so the full bandwidth.
- TV The time-base triggers on TV synchronization pulses.
For the MTB TIME/DIV positions 0,2 μ s/div ... 50 μ s/div
TV Line automatically is selected.
For the MTB TIME/DIV positions 0,1 ms/div ... 0,5 s/div
TV Frame automatically is selected.

If TV triggering is selected, the LEVEL rotary knob is inoperative. Selection between positive (+) video or negative (-) video is now obtained by the SLOPE push-pull switch, which is combined with the LEVEL rotary knob.

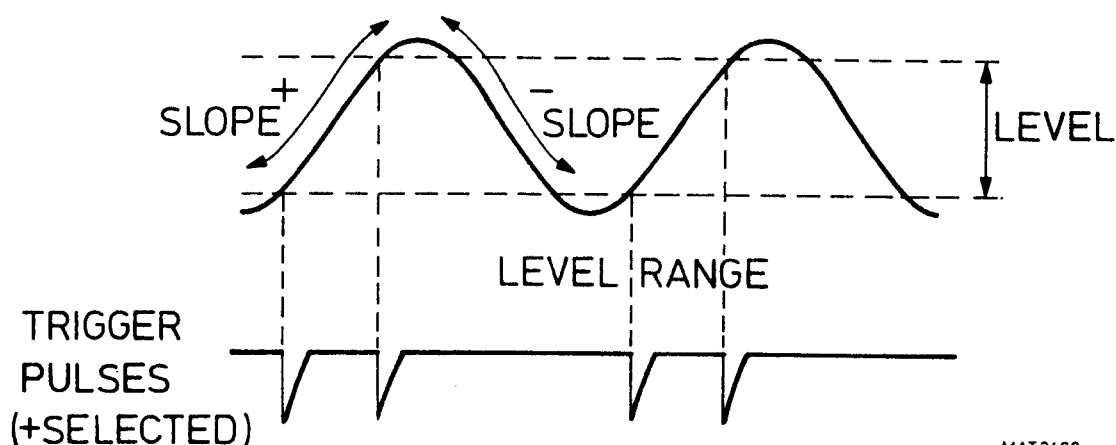


AC LF The trigger signal passes through a 50 kHz low-pass filter so reducing h.f. interference or noise.

AC The DC component of the trigger signal is rejected. This is useful when triggering must take place on a.c. signals superimposed on a large d.c. level.

- Trigger LEVEL and SLOPE adjustment

For repetitive signals, a stable, jitter-free display will only be obtained if each time-base sweep is triggered at precisely the same point on the signal waveform. The trigger level is adjusted with the TRIG LEVEL rotary knob and the time-base starts when the trigger signal reaches the pre-adjusted voltage level of this knob.



MAT 3468

The incorporated SLOPE push-pull switch determines then on which slope the sweep is started.

If positive, the time-base starts on the rising edge of the trigger signal.

If negative, the time-base starts on the falling edge of the trigger signal.

- Hold-off time adjustment

The HOLD-OFF rotary knob is used to prevent "false" triggering and "double writing" when examining multiple pulse signals. After the horizontal sweep is completed, triggering is inhibited for period of time set by the HOLD-OFF knob. Adjustment of the hold-off time enables triggering to be synchronized for the same pulse in the pulse train and so gives a stable display.

For example, consider a double pulse repetitive input signal. The selected trigger signal sees the same condition on the second pulse as the first pulse, and so the time-base sweep starts too soon. The double writing effect is seen as an extended base-line on the upper trace. Adjusting the hold-off time will inhibit the trigger unit until it sees the first pulse again.

